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MOUNTING FRAME AND LOOM FITTED WITH SAID MOUNTING
FRAME

The present invention relates to a heald frame and to a weaving loom equipped with such a frame.

5 It is known to equip a weaving loom with heald frames intended to be controlled in a reciprocating vertical movement thanks to an appropriate device, such as a weave system or a dobby. It is known to make a heald frame by reversibly assembling two struts and two cross-bars, the struts being substantially vertical when the heald frame is in configuration of use, while the
10 cross-bars are substantially horizontal.

FR-A-2 681 614 discloses a dismountable elastic junction device which may be used in an angle of a heald frame, i.e. in the zone of junction between a cross-bar and a strut. In this device, a protuberance made on a strut is intended to be wedged between two jaws fast with two rigid pieces forming heads
15 intended to be wedged inside a cross-bar. Taking into account the efforts of acceleration and of deceleration undergone by a heald frame, such a junction device induces very considerable stresses on the cross-bar, which may lead to a tear of the lateral walls of such a cross-bar.

Similar problems are raised with the device known from DE-A-33 08 371
20 in which a link of rigid type is made between a strut and a cross-bar of a heald frame, by means of a tensioning of the lateral faces of the cross-bar.

The problems identified hereinabove are more and more crucial insofar as it is desired that the weaving looms operate at higher and higher speeds, this implying that the heald frames be lightened to a maximum in order to reduce their inertia, by thus reducing the mechanical resistance of the cross-bars. *A*
5 *contrario*, the mechanical links between the struts and the cross-bars must be more and more robust in order to withstand the more and more violent accelerations and decelerations to which these mobile parts are subjected.

The invention aims at solving the problems of the prior devices by proposing a robust heald frame capable of being mounted on a loom operating at
10 high speed.

In this spirit, the invention relates to a heald frame for weaving loom, this frame being obtained by assembling two struts with two cross-bars each provided with a heald-carrier rod in one piece with the corresponding cross-bar or added thereon over substantially the whole of its length, at least one of the
15 extremities of at least one of the cross-bars being equipped with at least one member for locking a part of an adjacent strut, inside an end portion of the cross-bar which forms a zone of junction with this strut. This frame is characterized in that the aforementioned end portion comprises a part whose external transverse profile is substantially convex and at least one hoop which
20 surrounds the aforementioned part and the locking member, in order to resist a locking effort exerted by the latter.

Thanks to the invention, the hoop, which may be formed by a tubular sleeve or a bent sheet, makes it possible to improve the resistance of the cross-bar to the forces transmitted by the adjacent strut and resulting from the locking
25 of the aforementioned part of that strut. This consequently limits

the risks of deterioration of the cross-bar at the level of this zone of junction. In other words, the mechanical efforts undergone by the cross-bar in the zone of junction are reduced by the hoop, this improving the overall mechanical characteristics of the heald frame. The invention takes profit from the fact that the substantially convex profile of the zone of junction allows it to be associated with a hoop, while such would not be the case if this profile presented an opening or a cavity, for example for catching the extremities of the healds.

Other advantageous aspects of the invention, which may be associated with one another in any technically feasible combination, will be apparent from the accompanying dependent Claims.

The invention also relates to a weaving loom equipped with at least one heald frame as described hereinabove. Such a loom may operate at a high speed and is more reliable than those of the prior art.

The invention will be more readily understood and other advantages will appear more clearly in the light of the following description of a weaving loom and of a plurality of heald frames in accordance with its principle, given solely by way of example and made with reference to the accompanying drawings, in which:

Figure 1 schematically shows a weaving loom according to the invention.

Figure 2 is a partial, exploded section of a heald frame of the loom of Figure 1 at the level of the respective extremities of one of its struts and of one of its cross-bars.

Figure 3 is a section along line III-III in Figure 2.

Figure 4 is a section, on a smaller scale, of the upper and lower parts of a cross-bar

of a heald frame in accordance with a second form of embodiment of the invention.

Figure 5 is a section along line V-V in Figure 4.

Figure 6 is a section similar to the upper part of Figure 5 for a frame in
5 accordance with a third form of embodiment.

Figure 7 is a section similar to Figure 4 for a frame in accordance with a fourth form of embodiment of the invention.

Figure 8 is a section similar to Figure 4 for a frame in accordance with a fifth form of embodiment of the invention.

10 Figure 9 is a section similar to Figure 4 for a frame in accordance with a sixth form of embodiment of the invention.

Figure 10 is a section similar to Figure 4 for a frame in accordance with a seventh form of embodiment of the invention.

15 Figure 11 is a side view of the extremity of a cross-bar of a heald frame in accordance with an eighth form of embodiment of the invention.

Figure 12 is a view similar to Figure 11 for a heald frame in accordance with a ninth form of embodiment of the invention.

Figure 13 is a view similar to detail XIII in Figure 2, for a frame in accordance with a tenth form of embodiment of the invention.

20 Figure 14 is a view similar to Figure 2 for a frame in accordance with an eleventh form of embodiment of the invention.

Figure 15 is a section along line XV-XV in Figure 14,

Figure 16 is a section similar to Figure 15 for a heald frame in accordance with a twelfth form of embodiment of the invention.

Figure 17 is a partial section along line XVII-XVII in Figure 16, and

Figure 18 is a view similar to Figure 2 for a frame in accordance with a
5 thirteenth form of embodiment of the invention.

In Figure 1, a dobby 1 is intended to drive a heald frame 2 of a weaving loom M in a reciprocating vertical movement represented by arrows F_1 and F_1' . To that end, an arm 1a for actuating the dobby 1 is coupled by connecting rods and pivoting levers to each heald frame 2.

10 Each frame 2 is formed by the assembly of two struts 21 and of two cross-bars 22. The struts 21 extend substantially in a direction parallel to the direction Z-Z' of vertical oscillation of the frames 2, while the cross-bars 22 extend substantially in a direction Y-Y' perpendicular to the direction Z-Z' and substantially horizontal when the loom M is in configuration of use.

15 In the following description, the junction between the left-hand strut 21 and the upper cross-bar 22 of a frame 2 will be studied in greater detail. It is understood that the assembly of this cross-bar with the right-hand strut 21 or of the lower cross-bar with one or the other of the struts 21 may incorporate the same structural and functional characteristics.

20 As is more particularly apparent from Figure 2, the strut 21 is provided with a protuberance 21a intended to be introduced between two jaws 23 and 24 each fast with a solid piece 25, 26 respectively, articulated on each other inside the extremity 28

of the cross-bar 22. To that end, the cross-bar 22 is hollow and constituted by a tube of substantially rectangular cross section from which there extends, over substantially the whole of its length, a tab 29 forming a heald-carrier rod on which healds 30 for guiding the warp yarns of the loom M may be hooked.

5 In its median part, the cross-bar 22 is advantageously filled with a rigidifying and/or sound-proofing material.

The lower cross-bar is likewise provided with a heald-carrier rod.

The rod 29 is in one piece with the cross-bar 22 and connected thereto, over essentially the whole of its length, by a web 29c.

10 31 and 32 respectively denote the upper and lower short sides of the tubular part of the cross-bar 22. 33 and 34 respectively denote the lateral long sides of this part. 35 denotes the tubular part of the extremity 28 in which the pieces 25 and 26 are introduced. This part 35 is separated from the terminal part 29a of the heald-carrier rod 29 by a groove 36 which extends, from the terminal
15 face 28a of the extremity 28, in a direction Y_{36} - Y'_{36} parallel to a longitudinal axis Y_{22} - Y'_{22} of the cross-bar 22.

Assembly of elements 21 and 22 takes place by immobilizing the protuberance 21a between the jaws 23 and 24 thanks to the tightening of a manoeuvring screw 37. Due to the jaws 23 and 24 approaching each other,
20 represented by arrows F_2 and F'_2 , the pieces 25 and 26 exert on the sides 31 and 32 a locking effort represented by arrows F_3 and F'_3 . This effort is exerted through an element 27 made of elastomer disposed under stress between each piece 25 or 26 and the nearest short side 31 or

32. This elastomeric element is in accordance with the technical teaching of FR-A-2 681 614.

In order to be able efficiently to resist this effort of locking without risk of tearing the part 35, a hoop 40 is disposed around this part 35, being partially
5 engaged in the groove 36. This hoop 40 is constituted by a sheet-metal plate bent around the part 35 and immobilized therearound by cooperation of shapes and thanks to two screws 41 screwed in tapped orifices 42a of a counter-plate 42 introduced inside the part 35. The screws 41 also pass through a plate 43 for distributing over the length of the hoop 40 an effort F_5 of tightening of its
10 respective edges 40a and 40b on the side 31 of the part 35.

Part 35 and hoop 40 together form an end portion P of the cross-bar 22 which contains the locking means 25 and 26 and resists the locking effort F_3 and F'_3 .

The hoop 40 may efficiently perform its role of reinforcement of the part
15 35, as this part has an external transverse profile, constituted by the external surfaces of the sides 31 to 34, which is convex and therefore adapted to the use of such a hoop. In effect, if the hoop were disposed both around the part 35 and the terminal part 29a of the rod 29, the hooking of the healds in this zone would not be possible and the rod 29 might be crushed due to the existence of a cavity
20 or a hollow between the latter and the short side 32 of the part 35.

In this way, the groove 36 allows a suitable positioning of the hoop 40 around the part 35. The groove 36 has a length L_{36} greater than or equal to the width l_{40} of the hoop 40, part 29a of the rod 29 being in overhang over length L_{36} . In practice, the length L_{36} is slightly greater than the width l_{40} .

In the second form of embodiment of the invention shown in Figures 4 and 5, elements similar to those of the first embodiment bear identical references increased by 100. The cross-bar 122 of this embodiment is equipped with a hoop 140 which surrounds a part 135 of convex transverse profile of its extremity 128. 131 and 132 respectively denote the short sides, 133 and 134 the long sides of the part 135.

This embodiment differs from the preceding one essentially in that the immobilization of the hoop 140 around the part 135 takes place by blocking two wedges 144 and 144' connected by a screw 145 and adapted to cooperate with a complementary wedge 146 wedged against the inner surface 140c of the hoop 140 which is constituted by a tubular sleeve made of steel.

144a, 144'a, 146a and 146'a respectively denote the wedging surfaces provided on the wedges 144, 144' and 146, surface 146'a being the one of the wedge 146 intended to cooperate with the surface 144'a.

The end portion P formed by parts 135 and 140 may contain locking means, such as that of the first embodiment.

Unlike the first embodiment where parts 29 and 35 are in one piece, the rod 129 for hooking the healds of this second embodiment is added on the principal tubular part 135. To that end, the short side 132 of the part 135 is provided with a groove 138 in which may be inserted a ring 129b fast with the rod 129 and whose section is complementary of that of the groove 138, this making it possible to suspend the rod 129 from part 135. 129c denotes the junction web between the ring 129b and the part of the rod 129 on which the healds are hooked. As previously, this web extends

over substantially the whole length of the cross-bar 122 and is interrupted at the level of a terminal part 129a of the rod 129, this forming a groove 136 allowing the hoop 140 to be positioned.

As shown in Figure 6, the hoop 140 may be rounded above the
5 complementary wedge 146.

In the fourth form of embodiment of the invention shown in Figure 7, elements similar to those of the first embodiment bear identical references increased by 200. The cross-bar 222 of this embodiment is provided with a surface 222b inclined with respect to its longitudinal axis $Y_{222}-Y'_{222}$ and
10 intended to cooperate with the inclined surface 244a of a wedge 244 associated by a screw 245 with a stop 247 arranged against a lateral edge 240d of a hoop 240 in the form of a tubular metal sleeve. The traction exerted by the screw 245 on the wedge 244 makes it possible to tension the hoop 240 and thus to immobilize it around a part 235 of convex profile of the cross-bar 22 which
15 forms therewith an end portion P of the cross-bar 222.

In the fifth form of embodiment shown in Figure 8, elements similar to those of the first embodiment of the invention bear identical references increased by 300. A hoop 340 is arranged around a part 335 of a cross-bar 322 and forms therewith an end portion P. A wedge 344 is provided with an active
20 surface 344a which cooperates with an active surface 340c constituted by the inner face of the hoop 340, this face being inclined with respect to a longitudinal axis Y_{322}/Y'_{322} of the cross-bar 322. The displacement of the wedge 344 is controlled by a screw traversing a stop 347 disposed against a lateral edge 340d of the hoop 340.

25 In the sixth embodiment of the invention shown in Figure 9, elements similar to those

of the first embodiment bear identical references increased by 400. The hoop 440 of this embodiment is immobilized, by a layer of glue 448, around a part 435 of a cross-bar 422 with which it constitutes an end portion P. At the level of the upper short side 431 of the part 435, this layer of glue 448 is sufficiently
5 thick for a wedge 444 to be able to be inserted in the direction of arrow F_6 in Figure 9, this having the effect of positioning the hoop 440 and of ensuring a suitable distribution of the glue.

In the seventh form of embodiment of the invention shown in Figure 10, elements similar to those of the first embodiment bear identical references
10 increased by 500. A hoop 540 is immobilized around a part 535 of a cross-bar 522 by means of a screw 541 which traverses an orifice 540e made in the hoop 540 and which is screwed in a upper short side 531 of the part 535. In a variant, a plurality of screws of the type such as screw 541 may be used. An end portion P of the cross-bar 522 is formed by the elements 535 and 540.

15 As shown respectively in Figures 11 and 12, the longitudinal shape of a hoop 640 or 740 may be adapted to improve the progressive nature of the transmission of the efforts between the hoop and the cross-bar. In this way, the edge 640d of the hoop 640, which is opposite the terminal face 628a of the cross-bar 622, may have a pointed shape on one or the other of the sides of this
20 cross-bar, or on both. Inversely, and as shown in Figure 12, this edge 740d may have a hollow shape. These geometries of edges 640d and 740d are particularly adapted to the case of the link between the cross-bar and the hoop taking place by adhesion. They make it possible better to localize the

transmission of the efforts between the cross-bar and the hoop at the level of the end portion P.

In the tenth form of embodiment of the invention shown in Figure 13, elements similar to those of the first embodiment bear identical references increased by 800. A hoop 840 is immobilized around a part 835 of the extremity 828 of a cross-bar 822 of a heald frame. The part 835 has a substantially convex external transverse profile, while the cross-bar 822 is equipped with a heald-carrier rod 829. A groove 836 is formed between the part 835 and the rod 829 for the passage of the hoop 840 which is constituted by a plate of sheet metal bent around the part 835, like the hoop 40 of the first embodiment. The groove 836 does not open out on the terminal face 828_a of the extremity 828 but is formed by an oblong slot whose major axis $X_{836}-Y'_{836}$ is substantially parallel to the longitudinal axis $Y_{822}-Y'_{822}$ of the cross-bar 822.

In the eleventh form of embodiment of the invention shown in Figures 14 and 15, elements similar to those of the first embodiment bear identical references increased by 900. The frame of this embodiment comprises a strut 921 provided with a protuberance 921_a intended to be introduced inside an extremity 928 of a cross-bar 922.

To that end, the cross-bar 922 is hollow, at least in its end zone, and constituted in this zone by a tube of substantially rectangular cross section from which a rod 929 forming a heald-carrier rod extends, over substantially the whole of its length, on which healds 930 for guiding the warp yarns of the loom M may be hooked.

The lower cross-bar is likewise provided with a heald-carrier rod.

931 and 932 respectively denote the upper and lower short sides of the tubular part of the cross-bar 922. 933 and 934 respectively denote the lateral long sides of this part. 935 denotes the tubular part of the extremity 928 in which the protuberance 921a is introduced. This part 935 is separated from the terminal part 929a of the heald-carrier rod 929 by a groove 936 which extends, from the terminal face 928a of the extremity 928, in a direction Y_{936} - Y'_{936} parallel to a longitudinal axis Y_{922} - Y'_{922} of the cross-bar 922.

A hoop 940 is disposed around the part 935, being partially engaged in the groove 936. Elements 935 and 940 together form an end portion P of the cross-bar 922.

The hoop 940 is tensioned around the part 935 of the cross-bar 922 thanks to two wedges 944 and 944' connected by a screw 945 and adapted to cooperate with a complementary wedge 946 wedged against the inner surface 940c of the hoop 940.

944a, 944'a, 946a and 946'a respectively denote the surfaces or ramps for slide provided on the wedges 944, 944' and 946, surface 946'a being that of the wedge 946 intended to cooperate with surface 944'a. Surfaces 944a and 944'a are inclined with respect to the longitudinal axis of the screw 945, i.e. to the longitudinal axis Y_{922} - Y'_{922} , by two angles α_1 and α_2 of opposite directions and of the same absolute value.

Each long side 933 and 934 of the part 935 is provided with a supple slot 949 which allows introduction of the protuberance 921a in the part 935 then tightening of this part around this protuberance, when the wedges 944 and 944' approach each other.

In this way, the mechanical members 944 to 946 make it possible, by themselves, both to immobilize the protuberance 921a in the

part 935 and to tension the hoop 940 around this part. In practice, the screwing of the screw 945 in the wedge 944 has the effect of bringing closer to each other the wedges 944 and 944', of which the surfaces or ramps 944a and 946'a slide against the surfaces or ramps 946a and 946'a, this having the effect of displacing
5 the wedges in the direction of the rod 929.

These wedges exert on the part 935 an effort F_9 directed towards the rod 929 and the part 935 is deformed, thanks to the suppleness obtained by the slot 949. Such deformation of the part 935 results in an effort of immobilization F_{10} of the protuberance 921a in this part.

10 In addition, the relative slide of the wedges 944 and 944', on the one hand, and 946, on the other hand, has the effect of transmitting to the hoop an effort F_{11} of tensioning of this element. It will be noted that, taking into account the closed nature of the hoop 940, the effort F_{11} is transferred to the level of the part of the hoop traversing the groove 936, this having the effect of tightening the
15 protuberance 921a by the combination of the efforts F_{10} and F_{11} .

In practice, the efforts F_{10} and F_{11} are balanced out.

It will be noted that the geometry of the strut 921 is particularly simple as the protuberance 921a is in one piece with a principal part 921b of the strut 921 which extends parallel to the direction Z-Z' of oscillations of the frame.

20 The hoop 940 may perform its role of reinforcement of the part 935 efficiently, as this part has an external transverse profile constituted by the external surfaces of the sides 931 to 934, which is convex and therefore adapted for the use of such a hoop.

Furthermore, the protuberance 921a is provided, at the level of its respective upper and lower sides, with two pointed parts 921g and 921h
25 intended to penetrate in hollow housings 932g and 931h respectively provided in the short sides 932 and 931 of the

part 935. Parts 921g and 921h are each defined between two V-surfaces 921i and 921j which are substantially planar and parallel to axis Y_{922} - Y'_{922} . These surfaces are inclined, in the plane of Figure 3, by an angle γ of the order of 45° with respect to a plane P'_2 perpendicular to the principal plane P_2 of the frame 2.

5 The angle γ may, in practice, have a value included between 20 and 70° . In other words, the upper and lower sides of the protuberance 921a are of substantially triangular section. In a variant, only one of these sides may have such a geometry.

The internal geometry of the cross-bar 922 is adapted to that of the

10 protuberance 921a and housings 932g and 931h are defined between two inclined surfaces, 932i and 932j and 931i and 931j respectively, forming the same angle γ with the plane P'_1 .

In this way, the bearing between the cross-bar 922 and the element 921a that it contains occurs via two sets of surfaces 921i, 931i and 932i, on the one

15 hand, and 921j, 931j and 932j on the other hand, distributed on either side of the plane P_2 and inclined with respect thereto.

The surfaces 921i and 921j are oblique with respect to one another, in the same way as surfaces 931i and 931j, on the one hand, 932i and 932j, on the other hand.

The inclined nature of the surfaces 921i, 921j, 931i, 931j, 932i and 932j

20 makes it possible to improve adherence between the elements 921 and 922.

In the twelfth form of embodiment shown in Figures 16 and 17, elements identical to those of the first embodiment bear identical references increased by 100. The strut 1021 of this embodiment likewise comprises a protuberance 1021a in one piece with an elongated part 1021b, this protuberance being

25 intended to be inserted in a part 1035 of the extremity 1028 of a cross-bar 1022. As previously, a hoop 1040 is

disposed around the part 1035 and forms therewith an end portion P.

In this embodiment, the mechanical means for immobilizing the protuberance and for tensioning the hoop are not disposed between the part 1035 and the hoop, as in the first embodiment, but inside the part 1035. More
5 precisely, two wedges 1044 and 1044' are controlled, in a movement of displacement parallel to a longitudinal axis $Y_{1022}-Y'_{1022}$ of the cross-bar 1022, by a screw 1045.

1044a and 1044'a respectively denote the surfaces of these wedges 1044 and 1044' forming ramp. These surfaces cooperate respectively with surfaces
10 1021c and 1021d forming ramp provided on the protuberance 1021a, with angles of inclination β_1 and β_2 , with respect to the longitudinal axis of the screw 1045 and to axis $Y_{1022}-Y'_{1022}$, of opposite direction and with the same absolute values.

The protuberance 1021 is also provided with a rod 1021e provided with
15 an orifice 1021f for passage of the screw 1045.

As a function of the tightening of the screw 1045, there is exerted on the short sides 1031 and 1032 of the part 1035 an effort F_{11} transmitted to the hoop 1040 for tensioning thereof. As previously, the effort F_{11} is transferred by the hoop 1040 in the lower part of the protuberance 1021a in Figure 16.

20 Furthermore, the ramps 1044 and 1044' exert on the corresponding ramps of the protuberance 1021a an effort F_{10} of immobilization of this protuberance.

As is more particularly visible in Figure 5, the substantially convex nature of the profile of part 1035 may be obtained by integrating a filling element 1050 in a hollow part 1022a of the cross-bar 1022. In a variant, the filling element
25 may be connected with the hoop 1040 before the latter is positioned around the part 1035.

The screw 945 is offset, perpendicularly to the axis Y_{922} - Y'_{922} and with respect to part 921b of the strut 921, beyond the protuberance 921a. Similarly, the screw 1045 is offset with respect to part 1021b. In this way, these screws are easy to manoeuvre without it being necessary to pierce the principal parts of the struts.

In the thirteenth form of embodiment shown in Figure 18, elements similar to those of the first embodiment bear identical references increased by 1100. The metallic strut 1121 of this embodiment is provided with a tenon or protuberance 1121a in one piece with the principal part 1121b of the strut.

The cross-bar 1122 of this embodiment comprises a principal part 1122a advantageously made of synthetic material. This part 1122a is in one piece with a heald-carrier rod 1129 to which it is connected by a web 1129c. The cross-bar 1122 also comprises a metal hoop 1140 which is glued around one extremity 1128a of the part 1122a. 1148 denotes the layer of glue interposed between the elements 1140 and 1128a. The hoop 1140 extends in the direction of the principal part 1121b of the strut 1121 beyond the extremity 1128a. 1140a denotes the part of the hoop surrounding the extremity 1128a of the synthetic portion 1122a of the cross-bar 1122. 1140b denotes the part of the hoop 1140 which extends beyond the part 1128a and which defines a tubular portion 1135 of the cross-bar 1122 provided to receive the tenon 1121a. The elements 1128a and 1140 together form an end portion P of the cross-bar 1122.

As previously, a notch 1136 is made between the principal part 1122a of the cross-bar 1122 and the heald-carrier rod by means of a localized recess of the web 1129c. The heald-carrier rod 1129 is in overhang over a part of its length.

A nut 1126 is immobilized on an internal face of the part 1140b of the hoop and is traversed by the stem 1125a of a locking screw 1125. The stem 1125a and the nut 1126 constitute means for locking the tenon 1121a, located inside the part 1140b of the hoop 1140.

5 This embodiment presents the particular advantage that the dismountable link between the tenon 1121a and the hoop 1140 employs only pieces of high resistance in abutment against one another, which are advantageously made of metal. In addition, the whole interior volume of the hoop 1140 is available for positioning the tenon 1121a whose height and thickness may be increased with
10 respect to those of the corresponding parts of the frames of the other embodiments.

According to a variant of the invention (not shown) applicable to different forms of embodiment, the hoop may be immobilized on the cross-bar by hot-crimping.

15 Whatever the form of embodiment considered, the hoop remains in place on the cross-bar when the frame is dismantled, this making it possible, in particular, for it to protect the extremities of those parts of this cross-bar which are advantageously made of synthetic material.

20 Whatever the form of embodiment of the invention considered, the heald-carrier rod remains fast with the cross-bar, this implying that the healds used are of "open" type.

The invention has been represented with mechanical means comprising two wedges cooperating for the immobilization of the strut and the tensioning of the hoop. However, it is applicable with one sole wedge provided with one sole
25 effort transmission ramp.

The invention is applicable independently of the material used for the parts constituting the frames,

particularly the struts and the cross-bars. In particular, it is applicable to frames made of light alloy such as aluminium, and to frames of composite materials, with an organic resin and carbon- or glass-reinforced fibres. In addition, the hoops may be made of metal or of composite material.

5 The invention is applicable independently of the geometry of the heald-carrier rods of the cross-bars which may have different shapes adapted to that of the extremities of the healds.

 The characteristics of the different forms of embodiment described hereinabove may be combined together within the scope of the present
10 invention. In particular, inclined surfaces similar to surfaces 921i, 921j, 931i, 931j, etc... of the eleventh embodiment may be provided in the twelfth embodiment at the level of the protuberance 1021a, between the cross-bar 1022 and this protuberance, at the level of the lower short side 1032, and/or between the cross-bar 1022 and the wedges 1044 and 1044', at the level of the upper short
15 side 1031.